

and subsequent course entitle it to be placed among that class of storms known as West Indies' cyclones.

The following report of Mr. A. P. Goodman, mate of bark "Florence," of Boston, located at Barbadoes during the time it prevailed in that vicinity, will illustrate its severity:

July 20th.—During the last two days we have had light squally weather, with rain showers and very close, sultry weather and a falling glass. At 4 a. m., Greenwich time, 20th of July, the weather commenced to threaten, the glass having fallen to 29.64. We put out extra ropes and lines and made all secure for a blow; at 6 a. m. blowing heavy, with squalls of rain and a sea rolling in from the sse.; 7.30, wind increasing in the squalls; 8.30, in a terrific squall we parted all our lines and drove over to the other side of the Creek, doing considerable damage; about the same time we saw distress signals out to the Roads, and when daylight broke it was something terrific to look at, there being no less two barks, one barkentine, one brigantine, one two-masted schooner, one small steamer, and two condemned vessels on the shore; one bark and barkentine completely broken up; the sea was like a mountain on the shore.

The path pursued by this cyclone, as determined by a number of vessels' logs, reports, and observations received from vessels sailing on the Gulf of Mexico, the Caribbean Sea, and vicinity, appears to have been a little south of Barbadoes on the 20th, moving east. It then moved eastward over the central portion of the Caribbean Sea just north of N. 15° to W. 85°, then northwest over the extreme eastern portion of Yucatan to about N. 25°. At about the latter point its path seems to have been northerly for a few degrees and then changed to northeast. It arrived on the coast of western Florida on the morning of the 27th, with a minimum pressure of 29.60 and a wind-velocity of fifty-four miles per hour or more. After reaching the coast of Florida its course con-

tinued northeast to the vicinity of Augusta, Ga., then westward, arriving in northern Mississippi on the evening of the 31st, where it finally disappeared early in August. Its progress through the Caribbean Sea and the Gulf of Mexico appears to have been between fifteen and twenty miles per hour, and was accompanied by destructive winds and heavy rainfall. Reports of a number of vessels wrecked have been received from the western Florida and northern Cuban coasts.

The progress of the cyclone after leaving the Gulf of Mexico was reduced to about ten miles per hour. Its violence also appears to have been slightly reduced, judging from the following maximum wind-velocities, in miles per hour: Cedar Keys, Fla., 54; Pensacola, Fla., 36; Jacksonville, Fla., 36; Savannah, Ga., 36; Augusta, Ga., 20; Atlanta, Ga., 30; Mobile, Ala., 26. The rainfall was very heavy in Florida, Georgia, and eastern Alabama. The following are the total amounts, in inches, reported during the time the influence of the cyclone prevailed: Jacksonville, Fla., 3.50; Titusville, Fla., 4.54; Cedar Keys, Fla., 8.00; Pensacola, Fla., 1.34; Montgomery, Ala., 3.57; Atlanta, Ga., 8.93, and Augusta, Ga., 6.02. This heavy rainfall, in connection with the high winds and swollen rivers, was very destructive to the growing crops and public highways.

Through the kindness of Padre B. Vifas, S. J., Director of the Magnetic and Meteorological Observatory, Belen College, Havana, Cuba, the Chief Signal Officer was kept informed by telegraph of the progress of the cyclone before it reached the coast of the United States, and timely warning was given to the shipping on the Gulf and south Atlantic coasts, both by cautionary wind signals and special storm messages.

#### NORTH ATLANTIC STORMS DURING JULY, 1887.

[Pressure in inches and millimetres; wind-force by Beaufort scale.]

The paths of the depressions that have appeared over the North Atlantic Ocean during the month are determined, approximately, from international simultaneous observations furnished by captains of ocean steamships and sailing vessels; abstracts of ships' logs and other data collected by the Signal Service agencies at the ports of New York, Boston, and Philadelphia; reports received through the co-operation of the "New York Herald Weather Service;" and from other miscellaneous data received at this office up to August 21, 1887.

Seven depressions are traced, of which two passed eastward over the northern extremity of Newfoundland and advanced to the northward of the British Isles; two moved eastward from the coast of the United States south of the forty-fifth parallel, and three first appeared over mid-ocean. The general course of direction of the depressions was east-northeast, and their rate of progression was, as a rule, slow. Barometric pressure ranging below 29.00 (736.6) was reported on the 8th over mid-ocean, and on the 26th to the southward of Iceland.

The more severe storms of the month were included within three periods, viz., from the 7th to the 12th hard gales prevailed over mid-ocean, attending the passage of depressions numbers 2 and 3; during the 13th, 14th, and 15th fresh gales were occasioned to the southward and eastward of Newfoundland by depression number 4, and from the 25th to the 28th, inclusive, fresh to whole gales occurred from the thirtieth meridian to the British Isles, accompanying depressions numbers 6 and 7. No storm of marked violence occurred off the Atlantic coast of the United States, although moderate gales and unsettled weather were reported west of the fifty-fifth meridian and north of the thirty-fifth parallel during the greater portion of the second and the latter part of the third decades of the month.

From the 11th to the 14th, inclusive, and during the 27th and 28th, the barometric pressure in the vicinity of the Azores was relatively low; during the balance of the month the barometer continued high in that locality. Over mid-

ocean the pressure was high in the trans-Atlantic routes until the 5th, from which date until the 12th the barometer was generally low and fluctuating. During the second decade generally high pressure prevailed, except to the northward of the British Isles and west of the forty-fifth meridian. During the third decade the barometer continued low in, and to the northward of, the trans-Atlantic routes east of the thirty-fifth meridian. The cyclone which passed eastward over the Caribbean Sea and over the Gulf of Mexico during the third decade of the month is described under the heading of "Areas of low pressure."

In July, 1886, twelve depressions appeared over the ocean, of which seven were continuations of areas of low pressure traced on the North American continent; three storms traversed the ocean from coast to coast, one of which first appeared in the Caribbean Sea and passed into the Gulf of Mexico, whence it advanced northeast to the northward of the British Isles, closely following the course of the Gulf Stream.

In July, 1887, the storms, while being somewhat less frequent than in corresponding months of previous years, were of unusual summer strength to the eastward of the fortieth meridian during the three storm periods herein referred to.

The following are brief descriptions of the depressions traced:

1.—This depression was central on the 2d over the northern portion of the Gulf of Saint Lawrence, with barometric pressure ranging to about 29.70 (754.4), whence it moved northeast to about N. 54°, W. 51° by the 3d, with an apparent decrease in central pressure. During the next three days the storm-centre is given a probable track along the fifty-fifth parallel, after which it moved southeast and united with depression number 2 in N. 50°, W. 24° on the 7th.

2.—This depression originated southeast of the Banks of Newfoundland on the 6th, and, moving northeast, united with depression number 1 on the 7th, on which date barometric pressure about 29.30 (744.2) was shown. By the 8th the centre of depression had moved north-northeast to N. 55°, W. 21°,

with barometer readings ranging below 29.00 (736.6), after which it circled westward four degrees, with a marked increase in pressure; during the 10th and 11th the storm moved northeast to the north of Scotland, with an appreciable loss of energy, and disappeared beyond the region of observation after the latter date.

The following special reports refer to disturbances encountered during the passage of depressions numbers 1 and 2:

Capt. T. H. Gove, of the s. s. "Llandaff City," reports a storm of hurricane force on the 7th and 8th; wind veered from sw. to nw.; lowest barometer, 28.88 (733.5), at 9 p. m. of the 7th, in N. 51° 47', W. 21° 16'. Capt. T. Roberts, of the s. s. "Scythia," reports a strong s. to w. gale during the 7th and 8th, between N. 51° 20', W. 15° 32', and N. 50° 47', W. 21° 08'; lowest barometer, 29.30 (744.2), at 5.30 p. m. of the 7th, in N. 51° 9', W. 17° 56'. The gale was accompanied by a high confused sea. Fourth Officer J. H. Donne, of the s. s. "City of Richmond," Capt. A. Redford, commanding, reports a strong s. to w. gale during the 7th and 8th; lowest barometer, 29.22 (742.2), at 8 p. m. of the 7th, in N. 50° 58', W. 17° 47'.

Capt. N. Maass, of the s. s. "Marsala," reports a whole w. to nw. gale from the 7th to 9th; lowest barometer, 29.18 (741.2), at 9 a. m. of the 8th, in N. 46° 26', W. 34° 31'. Commodore W. G. Randle, of the s. s. "Westernland," reports a strong nw. to sw. gale from the 7th to 9th; lowest barometer, 29.81 (757.2), at 9 a. m. of the 8th, in N. 44° 56', W. 38° 03'. Capt. J. Scott, of the s. s. "Buenos Ayrean," reports a moderate gale on the 7th and 8th; wind veered from ne. to e. and sw.; lowest barometer, 28.88 (733.5), at noon of the 8th, in N. 55° 29', W. 24° 04'.

3.—This depression passed eastward over the northern portion of Newfoundland during the night of the 7-8th, and was central on the morning of the 8th in about N. 51°, W. 55°; by the 9th it had advanced about five degrees east, and on the 10th the storm-centre was located in N. 53°, W. 38°, with evidence of great energy; moving slowly south of east the depression was central on the 11th in N. 52°, W. 29°, with pressure about 29.40 (746.7), whence it advanced east-northeast to the northwest of Ireland by the 13th, after which it passed beyond the region of observation.

The following special reports refer to this storm: Capt. M. de Jousselin, of the s. s. "La Bretagne," reports a moderate gale on the 8th; wind veered from sw. to w.; lowest barometer, 29.72 (754.9), at 8 a. m., in N. 42° 07', W. 58° 10'. Capt. E. H. Freeth, of the s. s. "British Princess," reports a moderate to fresh gale from the 7th to the 11th; wind veered from s. to w.; lowest barometer, 29.65 (753.1), at 8 a. m. of the 11th, in N. 46° 52', W. 31° 34'. From the 12th had strong sw. to w. wind to W. 62°.

4.—This depression advanced to the eastward of Nova Scotia by the 12th, with barometric pressure below 29.60 (751.8), and, passing slowly northeast during the 13th, 14th, and 15th, disappeared to the northward of the fiftieth parallel by the 16th. The storm possessed considerable energy, and pressure ranging to about 29.40 (746.7) was shown on the 14th and 15th.

5.—This depression first appeared off the coast of the United States in about N. 39° on the 18th, and moved east-northeast to the eastward of the Newfoundland Banks by the 20th, after which it dissipated. The depression, while being of slight depth, occasioned rain and fresh to whole gales during the 19th and 20th. The following special report has been rendered relative to this storm: Capt. Thos. Davis, of the s. s. "Boston City," reports a whole gale on the 19th; wind veered from s. to sw. and n.; lowest barometer, 29.74 (755.4), at 7 p. m. of the 19th, in N. 48° 31', W. 46° 30'.

6.—This depression is first charted in N. 55°, W. 25°, under date of the 25th, whence it moved northeast to N. 59°, W. 21° by the 26th, with central pressure below 29.00 (736.6), after which the storm-centre passed beyond the region of observation, although its presence to the northward of the British Isles was indicated by south to west gales and rain to the fiftieth parallel during the 27th and 28th. The storm pos-

sessed great energy throughout, as is shown by the following special reports:

Capt. W. Kuhlmann, of the s. s. "Main," reports a strong gale on the 26th and 27th; wind veered from sw. by w. to w. by n.; lowest barometer at 6 p. m. of the 26th, in N. 49° 50', W. 12° 54'. Capt. D. D. Galbraith, of the s. s. "Durham City," reports a heavy wsw. gale, lasting from 4 p. m. of the 26th to 4 a. m. of the 28th; sea very heavy from the westward; lowest barometer, 29.19 (741.4), at midnight of the 26th, between Bardsey Island and Cape Clear.

Capt. W. McMickan, of the s. s. "Umbria," reports: "A fresh w. to wnw. gale on the 25th and 26th; lowest barometer, 29.34 (745.2), at 4 a. m. of the 26th, in N. 50° 00', W. 25° 30'. At 4.30 a. m. of the 26th, or thirty minutes subsequent to the time of lowest observed barometric pressure, a tremendous sea struck the ship forward, carrying away rails of forward bridge, port side; also main upper bridge, and smashing number two hatchway. Water poured down into the forward steerage and forward saloon. The wave appeared to be about twelve feet higher than the ordinary sea running." This vessel was directly in the path of the storm's vortex, the centre of which evidently preceded the wave referred to by the time stated. Capt. H. E. Nickels of the s. s. "Noordland," reports a fresh gale from the 26th to the 28th; wind veered from wsw. to wnw.; thence backed to ssw., and ended at nnw.; lowest barometer, 29.26 (743.2), at noon of the 26th, in N. 49° 47', W. 15° 41'.

7.—This depression moved eastward, north of the fiftieth parallel, to N. 51°, W. 33° by the 27th, with central pressure about 29.30 (744.2), whence it passed northeast to N. 56°, W. 25° by the 28th, and to the north of Scotland by the 29th, with fresh to whole gales throughout.

The following special reports show the general character of the disturbances encountered during its passage:

Mr. T. Cornelius, observer on the s. s. "Scythia," Capt. T. Roberts, commanding, reports a whole gale on the 27th and 28th; wind backed from ssw. to sse., and veered to w.; lowest barometer, 29.30 (744.2), at 5 hours 46 minutes of the 27th, in N. 49° 30', W. 26° 34'. Capt. W. Kuhlmann, of the s. s. "Main," reports a whole gale on the 27th and 28th; wind veered from s. by w. to nw. by n.; lowest barometer at 2 a. m. of the 28th, in N. 49° 42', W. 20° 26'. Capt. A. G. Thompson, of the s. s. "Hekla," reports a strong gale on the 28th; wind backed from ne. to nw.; lowest barometer, 29.23 (742.4), at 2 a. m., in N. 52° 50', W. 32° 15'.

#### OCEAN ICE.

On chart i are also exhibited the limits within which icebergs and field ice were reported during July, 1887. These limits are determined from reports furnished by shipmasters, and from data collected by the Signal Service agencies.

The easternmost ice was passed on the 5th, in N. 52° 04', W. 41° 16'. By the s. s. "Buenos Ayrean," and the southernmost ice reported was observed in N. 43° 30', W. 50° 05', from the s. s. "Minola."

Ice was most frequently reported during the month over and off the eastern edge of the Banks of Newfoundland, and in and to the eastward of the Straits of Belle Isle; large quantities of ice and large icebergs being encountered in the vicinity of Belle Isle throughout the month.

As compared with ice reported during June, 1887, the southern limit of the ice region has contracted northward about three degrees, while the eastern limit is about two degrees further west. At the close of June no vessel-reports had been made from the north of Newfoundland, which would indicate that ice massed in that region had not broken up, and that as a consequence the route through Belle Isle Straits was not available; with the opening of July, however, reports show that this passage was effected.

As compared with July, 1886, the southern limit of ice is about one and one-half degrees further north, while the extreme eastern position in which ice was observed is about six degrees

further west. In the vicinity of Belle Isle the aggregate quantity of ice reported during July, 1887, greatly exceeded that reported during the corresponding month of 1886.

As compared with the corresponding month of previous years, the southern limit of ice for July, 1887, is about one degree north of the mean southern, and about three degrees east of the mean eastern, limit. More than the usual amount of ice has been encountered off the northern extremity of Newfoundland.

The following table shows the southern and eastern limits of the region within which ice was reported for July during the last five years:

Southern limit.			Eastern limit.		
Month.	Lat. N.	Lon. W.	Month.	Lat. N.	Lon. W.
June, 1883	42 42	49 57	July, 1883	46 47	45 44
June, 1884	46 24	50 02	July, 1884	48 36	46 28
July, 1885	42 14	48 30	July, 1885	48 00	44 00
July, 1886	42 59	49 18	July, 1886	45 52	*34 30
July, 1887	43 30	50 05	July, 1887	52 04	41 16

\* An isolated iceberg and some field ice.

Icebergs and field ice were reported as follows:

Date.	Vessels.	Position. Lat. N. Lon. W.	Remarks.
1	S. S. Scandinavian.....	44 36 52 48	One berg.
	S. S. Sarnia.....	To eastward and in Straits of Belle Isle.	Several bergs.
2	Bk. J. W. Holmes.....	45 40 49 15	One large berg and field ice.
	S. S. Sarmatian.....	51 27 56 21 to 52 44 52 00	Ten large bergs.
4	S. S. Minola.....	43 30 50 05	One berg.
	Bk. Laura Maria.....	47 27 45 15	One large berg.
	S. S. Buenos Ayres.....	Cape Norman to 52 04 41 16	Bergs.
5	S. S. Trave.....	47 08 47 07	A piece of ice.
7	S. S. Ethiopia.....	47 06 48 13	One very large berg.
	S. S. Spain.....	In Narrows, Saint John's, N. F.	One berg.
9	S. S. Lake Nipigon.....	46 44 47 23	Do.
	S. S. Lake Nipigon.....	Straits of Belle Isle	Many large and small bergs; also field ice.
10	do.....	52 36 52 30	One large and two small bergs.
11	S. S. York City.....	45 46 46 34	One berg.
13	S. S. Slavonia.....	46 35 46 48	Two large and several small bergs.
	S. S. Nova Scotian.....	Off entrance to Saint John's harbor.	Two large bergs.
	S. S. Anchora.....	45 55 44 27	One large berg.
15	S. S. State of Nebraska.....	47 20 50 10	Two large bergs.
	S. S. Devonian.....	46 58 50 25	One large berg.
16	S. S. Jan Breydel.....	43 36 44 20	One berg.
	S. S. Nevada.....	46 54 47 31	One very large berg.
	S. S. Trave.....	46 27 47 59	Two pieces of ice.
17	S. S. Grecian.....	46 43 47 32	One berg.
	S. S. Grecian.....	12 miles west of Greenly Island and through Straits of Belle Isle to N. 53° W. 51°.	Large quantities of ice and several very large bergs.
20	S. S. Boston City.....	49 20 50 48	One large and five small bergs.
21	S. S. Arizona.....	46 40 47 39	One large berg.
	S. S. Devonian.....	46 55 47 30	Do.
	S. S. Corona.....	46 46 47 38	Do.
	S. S. Maryland.....	48 00 47 30	Two medium bergs.
	S. S. Queen.....	47 50 48 44	One very large berg.
	S. S. Austrian.....	46 45 47 30	One large berg.
	S. S. Sarmatian.....	45 08 49 22	Do.
	S. S. Sarmatian.....	48 21 49 12	Do.
	S. S. Sarmatian.....	48 01 50 18	One very large berg.
	S. S. Sarmatian.....	52 48 51 11 to 51 27 56 51	One large berg.
22	S. S. Corona.....	48 21 49 12	One very large berg.
	S. S. Dorset.....	48 01 50 18	Do.
23	S. S. Ontario.....	47 30 50 00	One medium berg.
	S. S. Ontario.....	46 30 53 40	One berg.
24	S. S. Dorset.....	47 44 48 36	Several bergs.
25	S. S. Straits of Gibraltar.....	52 30 53 30	Three large bergs.
	S. S. Brooklyn City.....	50 29 47 29	One berg.
	S. S. Straits of Gibraltar.....	30 miles east of Belle Isle.	Several large bergs; also large bergs to and in the Straits of Belle Isle.
28	S. S. La Gascogne.....	49 49 48 44	One berg.
	S. S. Furnessia.....	47 50 48 30	Do.
	S. S. State of Georgia.....	46 13 46 01	One large berg.
	S. S. Lake Nipigon.....	46 01 46 35	Do.
30	S. S. State of Georgia.....	47 58 49 08	Two large and seven or eight small bergs.
	S. S. Lake Nipigon.....	Near Belle Isle and in straits.	Many large and small bergs.

## FOG.

The following table shows the limits of fog-areas on the north Atlantic Ocean during July, 1887, as reported by ship-masters:

Date.	Vessel.	Entered.			Cleared.		
		Lat. N.	Lon. W.	Time.	Lat. N.	Lon. W.	Time.
1	S. S. Prydian.....	42 06	65 15		42 06	66 00	
1	S. S. Eider.....	46 47	40 56		45 54	49 48	
1	S. S. Donau.....	42 20	55 45		42 50	48 50	
2	Brig. Arcot.....	41 22	69 12		40 49	69 14	
2	S. S. Scandinavian.....	43 18	59 06		43 20	59 20	
2	S. S. Donau.....	43 30	47 50		43 30	47 30	
3	S. S. Circassian.....	40 59	67 30		40 42	69 16	
3-4	S. S. Island.....	47 21	45 30		44 50	53 00	
4	S. S. Rialto.....	41 30	46 20		41 10	48 00	
4	S. S. Eider.....	41 14	65 59		40 34	69 36	
4	S. S. Main.....	41 45	52 03		41 52	50 54	
5	S. S. Island.....	43 50	54 00		43 10	58 05	
5	S. S. Main.....	44 01	42 54		44 34	43 00	
5	S. S. Greece.....	40 40	48 14	11 p. m.	40 59	46 42	6 a. m.
4-5	Brig. Arcot.....	39 05	73 46		Delaware River		
7	S. S. La Bretagne.....	43 00	49 20		42 45	52 35	
7-8	S. S. Servia.....	44 00	46 49		42 36	51 00	
8	Sp. Georg.....	41 20	48 27		40 59	48 30	
8	S. S. Bengore Head.....	42 23	52 20		42 24	49 28	
8-9	S. S. Ems.....	43 44	54 17		44 28	51 30	
9	do.....	45 38	47 18		46 28	44 37	
11	S. S. Australia.....	41 32	51 35		41 31	51 45	
11-12	S. S. Erin.....	41 15	46 45		41 14	48 30	
12	S. S. City of Richmond.....	41 33	46 36		40 49	48 48	
12-13	S. S. Celtic.....	43 43	49 00	11.52 p. m.	42 44	51 54	2.57 p. m.
13	S. S. Scythia.....	42 55	56 17		42 54	56 37	
13	S. S. Rhaetia.....	43 39	46 14		42 50	51 20	At inter-vals.
14	S. S. Leocadia.....	42 34	46 56		42 41	48 41	
14	S. S. Vaderland.....	44 59	38 48		44 50	39 21	
14	S. S. Italy.....	48 10	43 52		45 20	50 32	
14	S. S. Saale.....	44 52	50 12		43 26	56 39	
15	S. S. Ludgate Hill.....	45 16	48 38		44 32	51 36	
15	S. S. Warwick.....	47 32	46 10	3 a. m.	46 15	49 40	8 p. m.
15-16	S. S. Wyoming.....	47 32	43 34	7 a. m.	44 28	52 24	4 p. m.
16	S. S. Netley Abbey.....	42 45	49 05		42 43	50 20	
16	S. S. Trave.....	47 26	44 57		47 57	42 22	
17	S. S. Servia.....	40 20	67 50		40 25	67 00	
18	Sp. Georg.....	42 24	60 50		42 45	61 35	
18-20	S. S. Leerdam.....	47 35	42 46	9.20 p. m.	45 46	48 16	2.40 a. m.
20	S. S. Chateau Yquem.....	46 33	68 05	9.30 a. m.	40 30	69 48	4 p. m.
20-21	S. S. Aurania.....	47 30	38 00		43 03	51 50	
22	do.....	42 37	55 01		42 29	56 27	
22-23	S. S. Devonian.....	44 33	57 34		45 13	59 56	
23	S. S. Annaff.....	46 00	44 30		43 30	52 10	
24	S. S. Scythia.....	42 16	50 00		42 28	49 49	
24-25	do.....	42 33	49 38		44 32	44 51	
25-26	S. S. Annaff.....	41 12	66 20		40 40	69 30	
27	S. S. La Bourgogne.....	42 51	51 49	2 a. m.	46 10	49 06	10 p. m.
28	S. S. Umbria.....	43 40	47 35		42 20	52 30	
30	S. S. Hekla.....	46 20	44 30		45 30	46 00	
31	S. S. Main.....	47 27	43 10	11 a. m.	46 25	46 44	11.30 p. m.

On chart i the limits of fog-belts to the westward of the fortieth meridian are shown by dotted shading.

In the trans-Atlantic tracks fog was most frequently encountered between the forty-second and fifty-third meridians, and over and in the vicinity of George's Shoal, the southern limits of the fog-belts being in about N. 40° 30'. Between the fifty-third and sixty-fifth meridians there was a comparative absence of fog. Advices indicate that there was an unusual prevalence of fog near the Newfoundland Banks during the month, which fact may be attributed to the abnormally high air temperatures reported to the westward of the fortieth meridian, whereby the differences in temperature requisite to fog development were more marked along the southern edge of the Arctic current, and in the vicinity of the ice-fields. A study of the general meteorological conditions which prevailed during and preceding the development of fog over and near the Banks of Newfoundland shows that, as a rule, its denser formation attended the shift of wind to southerly in the eastern quadrants of low barometer areas, by means of which the warm, vapor-laden air from the Gulf Stream was blown over the surface of the ice-fields and Arctic current.

Out of a total of twenty-three days for which fog was reported over or near the Newfoundland Banks, the presence of a cyclonic centre in the vicinity of Newfoundland or Nova Scotia was shown on fourteen dates; on five dates a low barometer area was located in the Saint Lawrence Valley or Gulf, and on four dates the meteorological conditions were unsettled, with rain, following the passage to the eastward of a cyclonic area. In the vicinity of George's Shoal fog was

reported on eight dates, and the dependence of its development upon south to east winds was apparent, although the precipitation of fog atoms was evidently due more to the contact between cold, northerly winds to the westward of low barometer areas and the warm, humid air from the Gulf Stream that had been collected in that region by the winds preceding storm-centres, than to differences in temperature of air overlying the ocean currents. The forcing to the surface

of the colder, deep-flowing waters of the Arctic current over George's Shoal, doubtless contributed to denser and more frequent fog formations in that locality.

Reports show that in the vicinity of Newfoundland a disappearance of fog closely followed a shift of wind to northerly, and in instances wherein fog was encountered to the southward of the Banks its presence was occasioned by a drift of fog-banks following a shift of wind to northerly.

### TEMPERATURE OF THE AIR (expressed in degrees, Fahrenheit).

The distribution of mean temperature over the United States and Canada for July, 1887, is exhibited on chart ii by the dotted isothermal lines. In the table of miscellaneous data are given the monthly mean temperatures, with the departures from the normal, for the various stations of the Signal Service; the figures opposite the names of the geographical districts in the columns for mean temperature, precipitation, and departures from the normal, show respectively the averages for the several districts. The normal for any district may be found by adding the departure to the current mean for the district when the departure is below the normal, and subtracting when above. On chart iv the departures from the normal are illustrated by lines connecting stations of normal or equal abnormal values.

Over the region east of the one hundredth meridian, north of the thirty-fifth parallel (which embraces nearly the whole of the United States east of the Rocky Mountains), the month of July was exceptionally warm, the mean temperature over the greater part of the country named being more than 2° above the normal, while in the Lake region, Ohio Valley, and middle Atlantic states the excess ranged from 4° to 7°. The mean temperature was also above the normal in the plateau districts, but in this region the departures were very slight. In the Gulf States, over the eastern Rocky Mountain slope, and along the immediate coast of the Pacific the month was cooler than the average July, but the deficiency in the monthly mean temperature was generally less than 2°, although a few stations show more marked departures.

The following are some of the most marked departures from the normal temperature at Signal Service stations, where the period of observation covers ten years, or more:

Above normal.	Below normal.
Pittsburg, Pa..... 7.6	San Francisco, Cal..... 3.8
Buffalo, N. Y..... 6.9	Charleston, S. C..... 2.6
Toronto, Ontario..... 6.5	New Orleans, La..... 2.5
Port Huron, Mich..... 6.4	Vicksburg, Miss..... 2.1
Cleveland, Ohio..... 6.3	Brownsville, Tex..... 1.8
Kingston, Ontario..... 6.1	Rio Grande City, Tex..... 1.5
Erie, Pa..... 5.8	Montgomery, Ala..... 1.3
Columbus, Ohio..... 5.8	Galveston, Tex..... 1.1

At many of the Signal Service stations, where the period of observation extends back ten to fifteen years, the maximum, minimum, and the mean temperatures of July were the highest shown by the records. The intense heat of the second decade of the month caused great suffering in the region from the upper Mississippi valley eastward to the Atlantic, and the number of deaths and prostrations resulting therefrom was unusually large. The table of comparative maximum and minimum temperatures in the REVIEW for this month will be found of especial interest as showing the highest temperatures yet recorded at many stations.

The curves on chart v show the current and normal temperatures for July at the stations given in the following table. This chart is of special interest in connection with the notes given in this REVIEW relative to the unusually warm weather of July. The solid lines in the diagram referred to represent the normal for past years, and the dotted lines, the current temperature for July, 1887:

The following table shows the number of days on which the

temperature was normal, above the normal, or below, etc., at the several stations:

Stations.	Number of days.			Extremes.				Monthly mean excess, degrees.	Length of record, years.
	Normal.	Above normal.	Below normal.	Above normal.		Below normal.			
				Degrees.	Date.	Degrees.	Date.		
Buffalo, N. Y.....	29	2	12.7	3	3.7	10	6.9	15	
Louisville, Ky.....	3	21	11.7	29	5.0	3	4.3	14	
Milwaukee, Wis.....	3	20	18.	16	6.	24	4.4	15	
New York City.....	22	9	9.0	13	3.3	19	3.7	15	
Pittsburg, Pa.....	29	2	14.	17	3.	10	7.6	15	
Port Huron, Mich.....	1	27	14.3	16	6.7	23	6.4	11	
Saint Louis, Mo.....	3	25	13.	30	3.	22	5.7	15	
Washington City.....	1	22	10.3	29	2.0	4	4.5	15	

### RANGES OF TEMPERATURE.

The monthly, and the greatest and least daily, ranges of temperature, at Signal Service stations are given in the table of miscellaneous meteorological data.

The monthly ranges were greatest over the middle plateau and at stations along the northern border of the country from Washington Territory to Lake Superior, where they were generally above 50°; they were least along the south Atlantic, Gulf, and Pacific coasts, where they varied generally from 20° to 30°.

The following are some of the greatest and least monthly ranges at Signal Service stations:

Greatest.	Least.
Fort Klamath, Oregon..... 66.0	Eureka, Cal..... 16.9
Ashland, Oregon..... 65.0	San Diego, Cal..... 19.3
Fort Spokane, Wash..... 59.6	Key West, Fla..... 19.8
Boise City, Idaho..... 59.4	Corpus Christi, Tex..... 20.6
Poplar River, Mont..... 55.5	San Francisco, Cal..... 20.9
Huron, Dak..... 54.9	Fort Canby, Wash..... 21.6

The greatest daily ranges over the entire country varied from 16° at Key West, Fla., on the 2d, to 53° at Fort Klamath, Oregon, on the 5th; along the Atlantic and Gulf coasts, in the Lake region, Ohio and central Mississippi valleys they varied generally from 20° to 30°; in the Rocky Mountain region they generally exceeded 40°.

The least daily ranges varied from 5° to 10° at stations in the vicinity of the Atlantic, Pacific, and Gulf coasts; over the interior of the country they were generally from 10° to 15°, except in the Rocky Mountain districts, where they were 20° or more.

### HIGH TEMPERATURES.

The following notes, relative to the high temperatures of the month, have been received from Signal Service and voluntary observers:

Clinton, Clinton Co., Iowa: the period from the 5th to the 17th may be called the heated term of the month; the maximum temperature, 104°, occurred on the 16th; the mean temperature for the period named was 80°; both the maximum and mean are the highest on record at this place; on five days the temperature rose above 100°.

Red Bluff, Cal.: the temperature rose to 112° on the 8th; this is the highest since the establishment of the signal office in 1877.

Cairo, Ill.: on the 12th the weather was hot and sultry, maximum tempera-